Schematic layouts of some CRD experiments.

1) CRD: Treatment levels are t=5 where each treatment occurs in 3 cells (experimental units : n=3) and each cell is sampled once. CRD with experimental error.

A	**A**	**D**
B	**C**	**B**
D	**A**	**E**
E	**D**	**C**
B	**E**	**C**

Model	$Y_{ij} = \mu + \tau_i + \varepsilon_{ij}$
Source	Expected Mean Squares
Treatments	$\sigma^2 + n\sigma^2_\tau$
Error	σ^2

2) CRD: Treatment levels are t=5 where each treatment occurs in 3 cells (experimental units : n=3) and each cell is sampled twice (sampling units : d=2). CRD with both experimental error and sampling error.

A	**A**	**A**	**A**	**D**	**D**
B	**B**	**C**	**C**	**B**	**B**
D	**D**	**A**	**A**	**E**	**E**
E	**E**	**D**	**D**	**C**	**C**
B	**B**	**E**	**E**	**C**	**C**

Model	$Y_{ijk} = \mu + \tau_i + \delta_{ij} + \varepsilon_{ijk}$
Source	Expected Mean Squares
Treatment	$\sigma^2 + n\sigma^2_\delta + nd\sigma^2_\tau$
Experimental Error	$\sigma^2 + n\sigma^2_\delta$
Sampling Error	σ^2

3) CRD?: Treatment levels=5; each treatment occurs in one cell (experimental unit) and each cell is sampled three times. CRD with no experimental error, this experiment has sampling error only (Pseudo-replication).

C	**C**	**C**
A	**A**	**A**
D	**D**	**D**
E	**E**	**E**
B	**B**	**B**

Model	$Y_{ijk} = \mu + \tau_i + \varepsilon_{ijk}$
Source	Expected Mean Squares
Treatments	$\sigma^2 + n\sigma^2_\delta + nd\sigma^2_\tau$
Sampling Error	σ^2

Schematic layouts of some RBD experiments.

4) RBD: Three blocks (b=3) and five treatment levels (t=5) where each block has 5 cells (experimental units) and each treatment occurs once in each block and each is sampled once. RBD with experimental error only

Block 1	Block 2	Block 3
C	**B**	**D**
A	**C**	B
D	**A**	**E**
E	**D**	**A**
B	**E**	**C**

Model	$Y_{ij} = \mu + \tau_i + \beta_j + \varepsilon_{ij}$
Source	Expected Mean Squares
Treatment	$\sigma^2 + nb\sigma^2_\tau$
Block	$\sigma^2 + nt\sigma^2_\beta$
Error	σ^2

5) RBD: Three blocks (b=3) and five treatment levels (t=5) where each block has 5 cells, and each treatment occurs once in each block and each cell is sampled twice (d=2). In this case the residual error term measures only within cell variation.

Block 1		Block 2		Block 3	
C	**C**	**B**	**B**	**D**	**D**
A	**A**	**C**	**C**	**B**	**B**
D	**D**	**A**	**A**	**E**	**E**
E	**E**	**D**	**D**	**A**	**A**
B	**B**	**E**	**E**	**C**	**C**

Model	$Y_{ijk} = \mu + \tau_i + \beta_j + \tau\beta_{ij} + \varepsilon_{ijk}$
Source	Expected Mean Squares
Treatment	$\sigma^2 + n\sigma^2_{\tau\beta} + nd\sigma^2_\tau$
Block	$\sigma^2 + n\sigma^2_{\tau\beta} + nd\sigma^2_\beta$
Block*Treatment	$\sigma^2 + n\sigma^2_{\tau\beta}$
Error	σ^2

6) RBD: Blocks=3, Treatment levels=5; each block has 10 cells and each treatment occurs twice in each block. Each cell (treatment by block and within block replicate combination) is sampled once. In this case the residual error term measures between cell variation.

Block 1		Block 2		Block 3	
D	**C**	**A**	**E**	**C**	**A**
A	**E**	**B**	**A**	**D**	**B**
A	**E**	**E**	**C**	**A**	**E**
B	**C**	**C**	**D**	**D**	**B**
D	**B**	**B**	**D**	**E**	**C**

Model	$Y_{ijk} = \mu + \tau_i + \beta_j + \tau\beta_{ij} + \varepsilon_{ijk}$
Source	Expected Mean Squares
Treatment	$\sigma^2 + n\sigma^2_{\tau\beta} + nd\sigma^2_\tau$
Block	$\sigma^2 + n\sigma^2_{\tau\beta} + nd\sigma^2_\beta$
Block*Treatment	$\sigma^2 + n\sigma^2_{\tau\beta}$
Error	σ^2

Layouts of some other experiments.

7) CRD Split-plot : Main plot treatment levels are t_1=5, sub-plot treatment levels t_2=2 where each main plot treatment occurs in d=3 cells (experimental units) and each cell is subdivided into two parts (d=2) for one application of each level of the sub-plot treatment.

E_2 | E_1	**B_2 | B_1**	**D_1 | D_2**
A_2 | A_1	**C_1 | C_2**	**B_1 | B_2**
D_1 | D_2	**B_1 | B_2**	**C_2 | C_1**
E_2 | E_1	**D_2 | D_1**	**A_1 | A_2**
A_1 | A_2	**E_2 | E_1**	**C_1 | C_2**

Model	$Y_{ijk} = \mu + \tau_{1i} + \delta_{ij} + \tau_{2k} + \tau_1\tau_{2ik} + \varepsilon_{ijk}$
Source	Expected Mean Squares
Treatment	$\sigma^2 + nd\sigma^2_{\delta} + n\sigma^2_{\tau1\tau2} + nd\, t_2\sigma^2_{\tau1}$
Error a	$\sigma^2 + t_2\sigma^2_{\delta}$
SubPlot Treatment	$\sigma^2 + n\sigma^2_{\tau1\tau2} + nt_1\sigma^2_{\tau2}$
Interaction	$\sigma^2 + n\sigma^2_{\tau1\tau2}$
Error b	σ^2

8) RBD: Blocks=3, Treatment Levels=5; each block has 10 cells and each treatment occurs twice in each block. Each cell (treatment by block combination) is sampled twice.

Block				**Block**				**Block**			
D	**D**	**C**	**C**	**A**	**A**	**E**	**E**	**C**	**C**	**A**	**A**
A	**A**	**E**	**E**	**B**	**B**	**A**	**A**	**D**	**D**	**B**	**B**
A	**A**	**E**	**E**	**E**	**E**	**C**	**C**	**A**	**A**	**E**	**E**
B	**B**	**C**	**C**	**C**	**C**	**D**	**D**	**D**	**D**	**B**	**B**
D	**D**	**B**	**B**	**B**	**B**	**D**	**D**	**E**	**E**	**C**	**C**

Model	$Y_{ijk} = \mu + \tau_i + \beta_j + \tau\beta_{ij} + \delta_{ij} + \varepsilon_{ijl}$
Source	Expected Mean Squares
Treatment	$\sigma^2 + n\sigma^2_{\tau} + ns\sigma^2_{\tau\beta} + nsb\sigma^2_{\tau}$
Block	$\sigma^2 + n\sigma^2_{\gamma} + ns\sigma^2_{\tau\beta} + nst\sigma_{\beta}$
Treatment*Block	$\sigma^2 + n\sigma^2_{\gamma} + ns\sigma_{\tau\beta}$
Rep(Treatment*Block)	$\sigma^2 + n\sigma^2_{\gamma}$
Error	σ^2

9) Latin Square Design (LSD): Three rows (r=3) and three columns (c=3) for three treatment levels (t=3) where each treatment occurs in each row and column. Experimental units are row by column combination cells. There could also be several separate squares (blocks) and several sampling units within cells for Latin Square Designs.

C	**B**	**A**
A	**C**	B
B	**A**	**C**

Model	$Y_{ijk} = \mu + \rho_i + \beta_j + \tau_k + \varepsilon_{ijk}$
Source	Expected Mean Squares
Row	$\sigma^2 + nr\sigma^2_{\rho}$
Column	$\sigma^2 + nr\sigma^2_{\beta}$
Treatment	$\sigma^2 + nr\,\sigma^2_{\tau}$
Error	σ^2